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produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.--

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#### REMARKS

Claims 1-12, 26-37, 51-62, 76-82 and 84 having been withdrawn from consideration, Claims 13-25, 38-50, 63-75, 83 and 85-125 are now presented for examination. Claim 13-17, 20, 23- 25, 38-42, 48-50, 63-67, 73, 75 and 83 have been amended to define still more clearly what Applicants regard as their invention, in terms which distinguish over the art of record. Claims 84-125 have been added to assure Applicants of the full measure of protection to which they deem themselves entitled. Claims 13-16, 38-41, 63-66 and 83 are the only independent claims.

In response to the Examiner's request a copy of the PTO-1449 form of the information disclosure statement filed November 4, 2000 is enclosed herein.

The drawings has been objected to under 37 C.F.R. § 1.83(a) in that the "light quantity control means 217" and the "driving mechanism 218" described in the specification at pages 67 and 68 are not shown and in that Fig. 15 should be designated by a "PRIOR ART" legend. It is proposed to amend Fig. 33 by adding elements 217 and 218 to correspond to the disclosure at pages 67 and 68 in the specification. It is further proposed that Fig. 15 be labeled "PRIOR ART". The proposed changes are shown

indicated in red in the enclosed drawing sheets. Approval of the changes is respectfully requested.

The specification and the abstract have been carefully reviewed and amended as to matters of form. The specification has been amended to correct typographical errors at pages 6, 9 and 11.

The claims have been rejected under 35 U.S.C. § 112, first paragraph, in that the specification lacks an adequate explanation for the term "bight field illumination". The objected-to term has been changed in the specification to "bright field illumination" which is well recognized in the art and the objected-to term has been deleted from the claims. Accordingly, it is believed that the claims as amended fully meet the requirements of 35 U.S.C. § 112, first paragraph.

Claims 13-25, 38-50, 63-75 and 83 have been rejected under 35 U.S.C. § 112, second paragraph, as indefinite in that it is not understood how the claimed apparatus can perform its functions as claimed. As amended, each of independent Claim 13 recites exposure apparatus that includes first exposure means that illuminates a predetermined mask pattern with light to print the mask pattern on a predetermined exposure region and second exposure means that illuminates the predetermined mask pattern with light under a different illumination condition to print the mask pattern on the predetermined exposure region. The exposures are carried out prior to a development process. Independent Claims 14-16, 38-41, 63-66 and 83 also recite arrangements of first and second exposure means

that carry out exposures prior to a development process with different illumination arrangements.

The objected-to terms "common exposure region" and "bight field illumination" have been deleted in the claims. The term "mutual interference" in Claims 24 and 49 has been changed to "interference". The recitation of an "auxiliary pattern" in Claim 20 has been changed to "an auxiliary pattern having a shape different from that of a repetition of the desired pattern, disposed adjacent to the mask pattern.

In Claims 23, 48 and 73, the objected-to recitation "exposures of the exposure region under different illumination conditions are performed sequentially without a development process to the exposure region" has been changed to "the exposure wavelength of said first exposure means and the exposure wavelength of said second exposure means are substantially the same".

The recitation in Claims 24, 49 and 74 of "exposures of the exposure region under different illumination conditions are performed simultaneously without interference of lights in the different illumination conditions" is believed to be clear in view of the amendments to Claims 13-16. The objected-to terms "small  $\sigma$ " and "large  $\sigma$ " in the claims has been deleted. It is noted that the term " $\sigma$ " is defined in the specification at least at lines 20-25 of page 10.

In view of the foregoing, it is believed that 13-25, 38-50, 63-75 and 83 as amended fully meet the requirements of 35 U.S.C. § 112, second paragraph.

Claims 13-25, 38-50, 63-75 and 83 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 5,392,094 (Kudo). With regard to the claims as amended, this rejection is respectfully traversed.

Independent Claims 13-16 as amended are directed to exposure apparatus in which a first exposure unit illuminates a predetermined mask pattern with light of a predetermined wavelength under a first illumination condition to print the mask pattern on a predetermined exposure region. A second exposure unit illuminates the predetermined mask pattern with light of the predetermined wavelength under a second different illumination condition to print the mask pattern on the predetermined exposure region. Exposures by the first and second exposure units are carried out prior to a development process.

In Claim 14, the predetermined mask pattern is illuminated with a first sigma by the first exposure unit and is illuminated with a second different sigma by the second exposure unit. In Claim 15, the predetermined mask pattern is illuminated with light of a first NA by the first exposure unit and is illuminated with light of a second different NA by the second exposure unit. In Claim 16, the predetermined mask pattern is obliquely illuminated by the first exposure unit and is perpendicularly illuminated by the second exposure unit.

Independent Claims 38-41 as amended are directed to exposure apparatus that illuminates a predetermined mask pattern with an illumination system and projects light from the mask pattern onto a predetermined exposure region through a projection

system to print the mask pattern on the exposure region. In the apparatus, a first exposure unit illuminates the mask pattern under a first illumination condition and projects light from the mask pattern to the exposure region at a first spatial frequency passage spectrum of the projection system so that the exposure region is exposed with the same. A second exposure unit illuminates the mask pattern under a different second illumination condition and projects light from the mask pattern to the exposure region at a different second spatial frequency passage spectrum of the projection system so that the exposure region is exposed with the same. Exposures by the first and second exposure units are carried out prior to a development process.

In Claim 39, the predetermined mask pattern is illuminated with a first sigma by the first exposure unit and is illuminated with a second different sigma by the second exposure unit. In Claim 40, the predetermined mask pattern is illuminated with light of a first NA by the first exposure unit and is illuminated with light of a second different NA by the second exposure unit. In Claim 41, the predetermined mask pattern is obliquely illuminated by the first exposure unit and is perpendicularly illuminated by the second exposure unit.

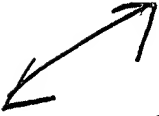
Independent Claims 63-66 as amended are directed to exposure apparatus in which a first exposure unit illuminates a predetermined mask pattern with light of a predetermined wavelength under a first illumination condition to print the same on a predetermined exposure region. A second exposure unit illuminates the mask pattern with light of the predetermined wavelength under a second different illumination condition to

print the same on the predetermined exposure region. The mask pattern has desired pattern and an auxiliary pattern having a shape different from that of a repetition of the desired pattern. Exposures by the first and second exposure units are carried out prior to a development process.

In Claim 64, the predetermined mask pattern is illuminated with a first sigma by the first exposure unit and is illuminated with a second different sigma by the second exposure unit. In Claim 65, the predetermined mask pattern is illuminated with light of a first NA by the first exposure unit and is illuminated with light of a second different NA by the second exposure unit. In Claim 66, the predetermined mask pattern is obliquely illuminated by the first exposure unit and is perpendicularly illuminated by the second exposure unit.

Independent Claim 83 as amended is directed to exposure apparatus that illuminates a predetermined mask pattern with an illumination system and projects light from the mask pattern onto a predetermined exposure region through a projection system to print the mask pattern on the exposure region. In the apparatus, a first exposure unit illuminates the mask pattern under a first illumination condition and projects light from the mask pattern to the exposure region at a first spatial frequency passage spectrum of the projection so that the exposure region is exposed with the same. A second exposure unit illuminates the mask pattern under a second different illumination condition and projects light from the mask pattern to the exposure region at a second different spatial frequency passage spectrum of the projection system so that the exposure region is exposed with the

same. The mask pattern has a repetition pattern including repeatedly disposed basic patterns defined by light transmissive portions. Light passed through adjacent basic patterns of the repetition pattern have a mutual optical phase difference of about 180 degrees. Exposures by the first and second exposure units are carried out prior to a development process.



In Applicants' view, Kudo discloses an illumination optical system in which a parallel beam supplying unit supplies parallel beams. A first optical integrator forms substantially first surface illuminants by the beams coming from the parallel beam supplying unit. A first converging optical system converges the beams from the plural secondary illuminants and a second optical integrator forms substantially second surface illuminants by the plural converged beams. A second converging optical system converges the beams from the second surface illuminants formed through the second optical integrator and illuminates an irradiated surface with the converged beams in superposition. At least one of the first optical integrator and the first converging optical system includes plural lens systems interchangeable each other and having focal lengths different from each other. One of the plurality of lens systems is inserted in a light path. The size of the second surface illuminants is thereby made variable while maintaining a fixed size irradiated area.

According to the invention defined in Claims 13-16, 38-41, 63-66 and 83, a first exposure unit performs a first exposure under a first illumination condition and a second exposure unit performs a second exposure under a second different illumination

condition. The multiple exposures are carried out under different illumination conditions before a development process.

Kudo may teach an exposure apparatus with a first aperture variable means and a second aperture variable stop in which the shape of an effective variable stop in an illumination system or the shape of a pupil of a projection system is changeable. As disclosed at lines 61-67 of column 3 in Kudo, "the size of second surface illuminates is made variable while maintaining an irradiated area to a fixed size. . . . the uniform irradiation of light on the irradiated surface can take place with a high illuminance without inducing any loss in the light quantity." The Kudo disclosure, however, is devoid of any suggestion of the feature of Claims 13-16, 38-41, 63-66 and 83 of first and second exposure means that illuminate a predetermined mask pattern under different illumination conditions prior to a development process. As a result, it is not seen that Kudo in any manner teaches or suggests exposures by first and second exposure means under different illumination conditions carried out prior to a development process as in Claims 13-16, 38-41, 63-66 and 83. It is therefore believed that Claims 13-16, 38-41, 63-66 and 83 as amended are completely distinguished from Kudo and are allowable thereover.

Claims 13-25, 38-50, 63-75 and 83 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 5,467,166 (Shiraishi). With regard to the claims as amended, this rejection is respectfully traversed.

In Applicants opinion, Shiraishi discloses an arrangement to effect projection exposure at a great depth of focus without spoiling transfer fidelity even for a



plurality of isolated patterns relatively close to one another in which a coherence reducing member reduces the coherency between imaging light in a central circular transmitting portion FA on or near the pupil plane (Fourier transform plane) of a projection optical system and imaging light in a marginal zonal transmitting portion FB. A double focalizing member DFM makes the in-focus position of light pass through the circular transmitting portion FA. The in-focus position of light passing through the zonal transmitting portion FB differs in the direction of the optical axis of the projection optical system.

As discussed with respect to Kudo, it is a feature of Claims 13-16, 38-41, 63-66 and 83 that exposure by a first exposure means that illuminates a predetermined mask pattern with light of a predetermined wavelength under a first illumination condition and exposure by a second exposure means that illuminates the predetermined mask pattern with light of the predetermined wavelength under a second different illumination condition are carried out prior to a development process. Shiraishi may teach use of a coherence reducing member having a central circular transmitting portion and a marginal zonal transmitting portion in a projection exposure arrangement. Shiraishi, however, is devoid of any suggestion of plural exposures under different illumination conditions prior to a development process as in Claims 13-16, 38-41, 63-66 and 83. Accordingly, it is believed that Claims 13-16, 38-41, 63-66 and 83 are completely distinguished from Shiraishi and are allowable.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as

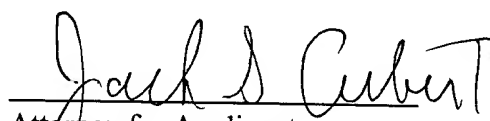
references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable consideration and reconsideration and early passage to issue of the present application.

Applicants' attorney, Steven E. Warner, may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

  
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